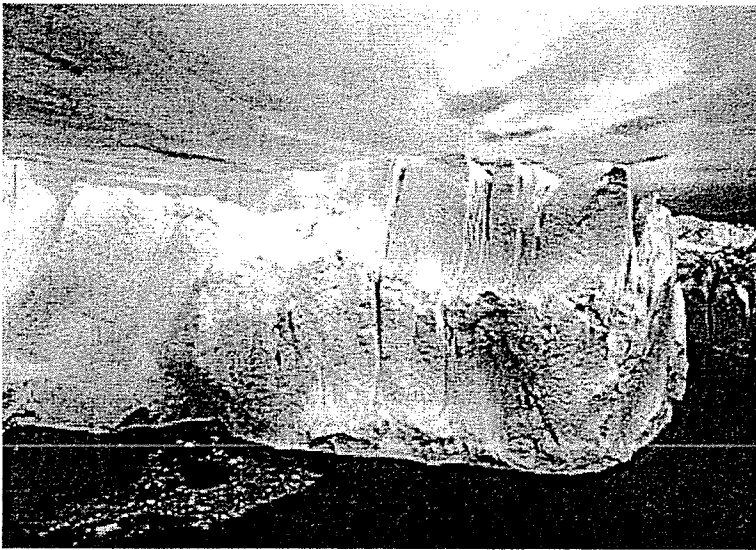


Newsweek Business

Tides Turning

A new book predicts that climate change is likely to be abrupt and cataclysmic—and that these sudden shifts could cripple national economies.



John McConnico / AP

Ice, like this section in Greenland, is thinning quickly



PHOTO GALLERY

WEB EXCLUSIVE

By Susanna Schrobsdorff

Newsweek

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March 25, 2006 - Last week, Britain's Prince Charles called climate change "the No. 1 risk in the world, ahead of terrorism and demographic change." But the prince, a long-time environmentalist, has some unlikely competition for the year's most strident statement on global warming. In a Feb. 6 address to the United Nations Security Council,

conservative Republican Sen. Richard Lugar called for action on global warming, citing recent advances in scientific knowledge on the subject: "The problem [of climate change] is real and caused by man-made emissions of greenhouse gasses, including carbon dioxide from fossil fuels." He went on to add that climate change could "bring drought, famine, disease, mass migration and rising sea levels threatening coasts and economies worldwide, all of which could lead to political conflict and instability."

Lugar is not the only one reassessing global warming. Last week, insurers, bruised by a devastating 2005 Atlantic storm season that saw an all-time high of 14 hurricanes, announced plans to establish a climate-change task force under the auspices of the National Association of Insurance Commissioners. Record insurance-industry losses of \$30 billion from 2004's hurricanes in the United States were dwarfed by the more than \$60 billion in insurance losses in 2005 from Hurricane Katrina alone. The industry says must recalibrate its risk models to account for the hurricanes and other severe weather from inland tornados, brushfires, ice storms and drought.



None of this is news to award-winning environmental journalist Eugene Linden. In his new book, "The Winds of Change" (*Simon & Schuster*), Linden traces cycles of climate change and how civilizations have responded throughout history. He reports that these shifts tend to be abrupt and catastrophic "flickerings," not the gradual warming we've generally expected. And while Linden acknowledges the controversy and contradictions in the science of predicting global warming, he says: "We know enough to realize that this is a very big deal, and we know it's happening much faster than we expected." NEWSWEEK's Susanna Schrobsdorff spoke with Linden about the science and politics of environmental change. Excerpts:

Marion Ettlinger
Linden: 'Even a 2-degree warming in the next 20 or 30 years could be incredibly ruinous'

NEWSWEEK: Did the catastrophe of Hurricane Katrina affect public attitudes about environmental issues?

Eugene Linden: Yes, I think Katrina was a tectonic shift. People have begun to appreciate that weather can be a weapon of mass destruction.

Katrina did more economic damage than the [9/11] World Trade Center attacks. The signals have become incontrovertible and the naysayers just sound silly.

There was a lot of speculation that the intensity of Hurricane Katrina was related to global warming. Is there any consensus on that?

There's never going to be perfect knowledge here, but we know that hot water is the energy source for hurricanes. We also know that you've seen the world warm over the

last few years, and hurricanes have intensified over the last 30 years. With global warming you'd expect more intense storms, and that's exactly what we are seeing.

The Bush administration been criticized for downplaying the risks of global warming. Has that changed in the wake of the costly 2005 hurricane season?

The Bush administration is in an extreme denial position. They have just had contempt for the problem as far as I can see. But we cannot wait until January of 2009 [when Bush leaves office] to start taking action. I think the business community will bring more pressure on them to do something. And the fact that Christian evangelicals are speaking out on environmental issues will help, as well. I think George Bush can change his mind on this. The world needs him to change his mind.

We usually think of global warming as a very slow process. But you say it's happening more quickly than predicted.

As recently as the 1980s, most scientists thought that climate change was a gradual and incremental affair. Then with the studies on the Greenland ice core, and seabed studies and all sorts of other studies, they have confirmed that climate has tended to flip back and forth and that historically it has gone through flickering stages, between warm and cold, as it seeks a new equilibrium. These flickering stages can last decades, creating whipsaw changes in climate that could be ruinous.

Are we prepared for sudden environmental changes?

If climate change was gradual and incremental, societies could deal with it and adjust their behavior to the risk. But if it's rapid and extreme, there's no society on earth that can deal with it. In fact, economists can't even model the impact. Most of the economic modeling you see about climate change is built on a gradual and incremental model, which doesn't exist in the environmental record. Even an economy that could absorb the cost of Katrina would have difficulty with a cluster of intense weather shocks—droughts, floods and ice storms and hurricanes.

You write about ancient civilizations wiped out by cycles of climate change. What do you say to those who question whether current warming is caused by human activities like the burning of fossil fuels?

If it's natural, we're really screwed; if it's human, which is likely, then at least we can do something about it. So I'd be hoping it's man-made. The one variable that's really out of whack with history is the increase in carbon dioxide in the atmosphere. Carbon dioxide has marched in lockstep with global warming. The signs are all around us—and so are the solutions.

What are the solutions?

In a perfect world, it's a carbon tax. But you can also look at the California situation when they had their energy crisis in 2001. It was amazing how good people were in reducing their energy use. Consumers can change their buying habits on a dime. There is enormous power to address this problem. But the main thing is that internationally, we have to get China and India in the game. And because we're the world's largest emitter of

greenhouse gasses, the U.S. government has to take a strong stand on this.

What potential economic repercussions are there from climate change at this pace?

To put it in perspective, an El Nino [a major temperature fluctuation in surface waters of the tropical eastern Pacific Ocean] might represent a 1 degree change in global temperatures. The 1998 El Nino did about \$100 billion dollars' damage to the global economy, but you have to scale up for each level of change dramatically because you pass what are called tipping points or thresholds. Katrina was only marginally more powerful than previous hurricanes, but it did over a hundred times the damage. A flood that's 10 percent higher than a previous flood can cause 10 times as much damage if it overtops levees. Even a 2 degree warming in the next 20 or 30 years could be incredibly ruinous just because it could impose a tax on everybody in every in terms of ice storms and disruption in weather and business.

What kind of tax?

For example, if insurance starts to rise in certain areas, and it already has in coastal areas, you get repercussions for the housing market. People have huge amounts tied up in housing and an enormous number of jobs and spending are in housing. And of course the financial system, which prices these risks, has to absorb it. The system is going to shift the risk back to individuals or government—that's what business does, and that's how risk gets aggregated. As these risks begin to become monetized, and if global warming intensifies, it could eventually cause an economy to come to a halt.

How have insurance companies reacted to the intensity of the storms we've already seen?

Traditionally, they've only looked back at what past weather has done, but now they are starting to base rates on anticipated changes in weather. Rates in some parts of south Florida have almost doubled. Flood insurance may end up being 10 times more expensive in parts of New Orleans as it was before. And some have even pulled out of Cape Cod [in Massachusetts], which is [more than] 1,000 miles away from where Katrina hit. That's how risk diffuses. And if an insurance company backs out, what bank is going to assume that risk? It causes real problems up the economic chain.

Are other industries making plans to cope with the risk of global warming?

One of the things we're seeing right now is a change in attitudes in corporate America about climate change and emissions. Jack Welch [former CEO of General Electric] was famously dismissive of climate change and global warming. But Jeffrey Immelt [Welch's successor at GE] has acknowledged the seriousness of it and other environmental concerns—and that's one of the largest corporations on the planet. I think that big business is actually going to put pressure on the White House to actually do something on climate change and emissions because they'd rather deal with one uniform policy than 17 different policies. And a lot of these big companies are multinationals. Even if the United States doesn't take the issue seriously, a lot of other places do, and they have to operate in those markets.

You write that humans are notoriously bad at assessing risk. Is that also why we haven't been more concerned about climate change before this?

With a long-wavelength phenomenon like climate change, by the time the signals come it's often too late. To paraphrase [Secretary of State] Condi Rice [in her pre-war statements on Iraq's nuclear capabilities], you don't want to have knowledge of global warming come when we have a ruined economy as a result of global warming. This is science in real time. We know enough to realize that this is a very big deal, and we know it's happening much faster than we expected.

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The Scientific Consensus on Climate Change

Naomi Oreskes

This year's essay series highlights the benefits that scientists, science, and technology have brought to society throughout history.

Policy-makers and the media, particularly in the United States, frequently assert that climate science is highly uncertain. Some have used this as an argument against adopting strong measures to reduce greenhouse gas emissions. For example, while discussing a major U.S. Environmental Protection Agency report on the risks of climate change, then-EPA administrator Christine Whitman argued, "As [the report] went through review, there was less consensus on the science and conclusions on climate change" (1). Some corporations whose revenues might be adversely affected by controls on carbon dioxide emissions have also alleged major uncertainties in the science (2). Such statements suggest that there might be substantive disagreement in the scientific community about the reality of anthropogenic climate change. This is not the case.

The scientific consensus is clearly expressed in the reports of the Intergovernmental Panel on Climate Change (IPCC). Created in 1988 by the World Meteorological Organization and the United Nations Environmental Programme, IPCC's purpose is to evaluate the state of climate science as a basis for informed policy action, primarily on the basis of peer-reviewed and published scientific literature (3). In its most recent assessment, IPCC states unequivocally that the consensus of scientific opinion is that Earth's climate is being affected by human activities: "Human activities ... are modifying the concentration of atmospheric constituents ... that absorb or scatter radiant energy. ... [M]ost of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations" [p. 21 in (4)].

IPCC is not alone in its conclusions. In recent years, all major scientific bodies in the United States whose members' expertise bears directly on the matter have issued similar statements. For example, the National

Academy of Sciences report, *Climate Change Science: An Analysis of Some Key Questions*, begins: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise" [p. 1 in (5)]. The report explicitly asks whether the IPCC assessment is a fair summary of professional scientific thinking, and answers yes: "The IPCC's

conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately

reflects the current thinking of the scientific community on this issue" [p. 3 in (5)].

Others agree. The American Meteorological Society (6), the American Geophysical Union (7), and the American Association for the Advancement of Science (AAAS) all have issued statements in recent years concluding that the evidence for human modification of climate is compelling (8).

The drafting of such reports and statements involves many opportunities for comment, criticism, and revision, and it is not likely that they would diverge greatly from the opinions of the societies' members. Nevertheless, they might downplay legitimate dissenting opinions. That hypothesis was tested by analyzing 928 abstracts, published in refereed scientific journals between 1993 and 2003, and listed in the ISI database with the keywords "climate change" (9).

The 928 papers were divided into six categories: explicit endorsement of the consensus position, evaluation of impacts, mitigation proposals, methods, paleoclimate analysis, and rejection of the consensus position. Of all the papers, 75% fell into the first three categories, either explicitly or implicitly accepting the consensus view; 25% dealt with methods or paleoclimate, taking no position on current anthropogenic climate change. Remarkably, none of the papers disagreed with the consensus position.

Admittedly, authors evaluating impacts, developing methods, or studying paleoclimatic change might believe that current

climate change is natural. However, none of these papers argued that point.

This analysis shows that scientists publishing in the peer-reviewed literature agree with IPCC, the National Academy of Sciences, and the public statements of their professional societies. Politicians, economists, journalists, and others may have the impression of confusion, disagreement, or discord among climate scientists, but that impression is incorrect.

The scientific consensus might, of course, be wrong. If the history of science teaches anything, it is humility, and no one can be faulted for failing to act on what is not known. But our grandchildren will surely blame us if they find that we understood the reality of anthropogenic climate change and failed to do anything about it.

Many details about climate interactions are not well understood, and there are ample grounds for continued research to provide a better basis for understanding climate dynamics. The question of what to do about climate change is also still open. But there is a scientific consensus on the reality of anthropogenic climate change. Climate scientists have repeatedly tried to make this clear. It is time for the rest of us to listen.

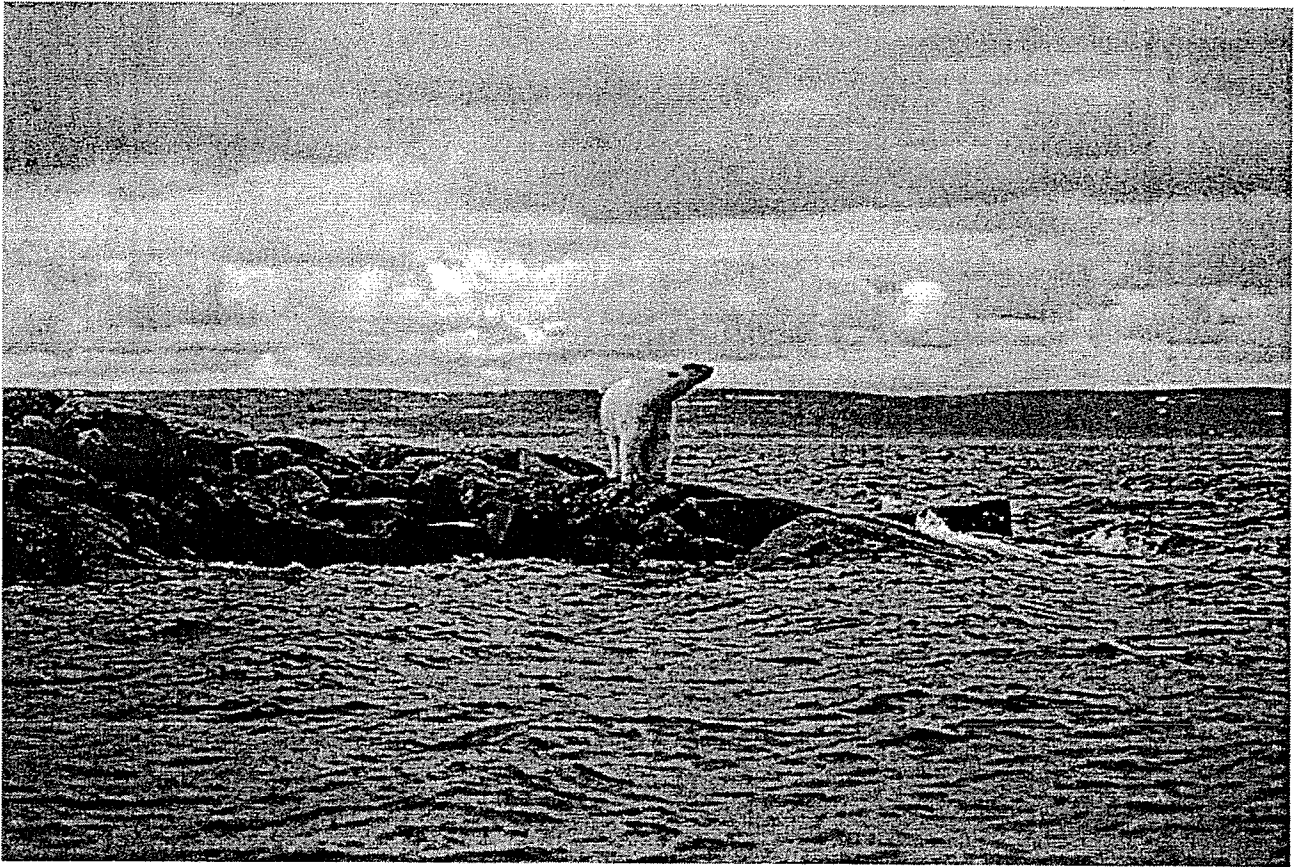
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9. The first year for which the database consistently published abstracts was 1993. Some abstracts were deleted from our analysis because, although the authors had put "climate change" in their key words, the paper was not about climate change.
10. This essay is excerpted from the 2004 George Sarton Memorial Lecture, "Consensus in science: How do we know we're not wrong," presented at the AAAS meeting on 13 February 2004. I am grateful to AAAS and the History of Science Society for their support of this lectureship; to my research assistants S. Luis and G. Law; and to D. C. Agnew, K. Belitz, J. R. Fleming, M. T. Greene, H. Leifert, and R. C. J. Somerville for helpful discussions.

The author is in the Department of History and Science Studies Program, University of California at San Diego, La Jolla, CA 92093, USA. E-mail: noreskes@ucsd.edu

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BEFORE THE SECRETARY OF THE INTERIOR
**PETITION TO LIST THE POLAR BEAR (*Ursus*
maritimus) AS A THREATENED SPECIES UNDER THE**
ENDANGERED SPECIES ACT



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February 16, 2005

On the Cover: Message on the Wind – Polar Bear ©Thomas D. Mangelsen/Imagesofnaturestock.com

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The decades of research by so many members of the scientific community whose published work is cited herein are also gratefully acknowledged. Protection of the polar bear would not be possible without the hard and selfless efforts of the researchers and managers who have devoted their careers to the understanding and protection of this magnificent animal.

Authors: Kassie Siegel and Brendan Cummings, Center for Biological Diversity



Executive Summary

Introduction

The polar bear (*Ursus maritimus*) faces likely global extinction in the wild by the end of this century as result of global warming. The species' sea-ice habitat is literally melting away. The federal Endangered Species Act ("ESA") requires the protection of a species as "Threatened" if it "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20) (emphasis added). A species is considered an "endangered species" when it "is in danger of extinction throughout all or a significant portion of its range." 16 U.S.C. § 1532(6). Unfortunately, the endangerment of the polar bear and its likely extinction are all too foreseeable, as both polar bear and climate scientists agree that the species cannot survive the ongoing and projected loss of its sea-ice habitat in a warming Arctic. Absent substantial reductions in emissions of greenhouse gases, by century's end average annual temperatures in the Arctic will likely rise upwards of 7° C (13.6° F) and summer sea ice will decline by 50-100%. The polar bear cannot survive such changes and therefore meets the statutory criteria for protection as Threatened under the ESA.

Petitioner, the Center for Biological Diversity, submits this Petition to the Secretary of the Interior and the United States Fish and Wildlife Service ("FWS") requesting formal protection of the polar bear as a Threatened species under the ESA. The ESA requires the Secretary and FWS to determine within 90 days of receiving the Petition whether the Petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). Such determination is to be made solely on the basis of the "best available science." 16 U.S.C. § 1533(b)(1)(A). Following a positive "90-day" finding, the Secretary and FWS must within one year of receipt of the Petition complete a review of the status of the species and publish either a proposed listing rule or a determination that such listing is not warranted. 16 U.S.C. § 1533(b)(3)(B). The Secretary and FWS then have an additional year to finalize the proposed rule. 16 U.S.C. § 1533(b)(6)(A). In sum, assuming the Secretary and FWS comply with the statutory timelines of the ESA, the polar bear must be formally designated as a Threatened species within two years of the receipt of this Petition. Critical Habitat for the polar bear must also be designated concurrently with the species' listing as Threatened. 16 U.S.C. § 1533(a)(3)(A). Once the polar bear is listed under the ESA, all federal agencies are required to "insure" that any action they take does not jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. 16 U.S.C. § 1536(a)(2). Listing under the ESA will have no effect on current Native Alaskan subsistence harvest of polar bears.

This Petition describes the natural history and biology of the polar bear, and the current status and distribution of the species. Next, the Petition reviews the primary threats to the continued existence of the polar bear, specifically how global warming will likely negatively and severely impact the species' habitat, prey, behavior, reproduction, and ultimately survival. The Petition also explains how existing law and regulations, both domestically and internationally, are inadequate to address these threats and prevent the endangerment and likely extinction of the polar bear. The Petition also details a host of additional threats to the polar bear, including oil and gas development in the Arctic, the accumulation of high levels of persistent organic pollutants such as PCBs in polar bear tissues, and unsustainable hunting practices, including illegal poaching, in some areas outside the United States. Global warming will likely also exacerbate some of these other threats. In sum, the Petition clearly demonstrates that the polar bear meets the legal criteria for listing as Threatened under the ESA and therefore the species must be promptly protected as such.



Scientists have been aware of global warming due to greenhouse gas emissions for over 30 years. That global warming is and will be more rapid and pronounced in the Arctic than in other areas of the world has been known and observed for nearly as long. Concern for the fate of the polar bear in a changing climate has been expressed for over a decade. However, in the past two years, with the release of the Arctic Climate Impact Assessment's ("ACIA's") report on *Impacts of a Warming Arctic* (ACIA 2004a), combined with a peer-reviewed analysis by three of the world's foremost experts on polar bears, *Polar bears in a warming climate* (Derocher, A.E., N.J. Lunn, and I. Stirling 2004), that the polar bear faces a very real likelihood of extinction in the foreseeable future cannot be dismissed as mere speculation. Rather, the "best available science" demonstrates that global warming is occurring, that Arctic sea ice is melting, and that absent significant reductions in human-generated greenhouse gases, such continued warming and consequent reduction of sea ice will occur that the polar bear will face severe endangerment and likely extinction in the wild by the end of the century.

The "Best Available Science" on Global Warming

That global warming as a result of anthropogenic greenhouse gas emissions (primarily carbon dioxide, methane, and nitrous oxides) is occurring and accelerating is no longer subject to credible scientific dispute. In 2001 the Intergovernmental Panel on Climate Change ("IPCC") released its *Third Assessment Report – Climate Change 2001*. The IPCC was established by the World Meteorological Organization and the United Nations Environment Programme in 1988. Its mission is to assess available scientific and socio-economic information on climate change and its impacts and the options for mitigating climate change and to provide, on request, scientific and technical advice to the Conference of the Parties to the United Nations Framework Convention on Climate Change. Since 1990, the IPCC has produced a series of reports, papers, methodologies, and other products that have become the standard works of reference on climate change (IPCC 2001a). The *Third Assessment Report* is the product of over 2000 scientists from 100 countries participating in the most rigorously peer-reviewed scientific collaboration in history. In its *Summary for Policymakers*, the IPCC (2001a:10) unequivocally stated that "[t]here is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." The IPCC further concluded that:

Projections using the SRES [*Special Report on Emissions Scenarios*] emissions scenarios in a range of climate models result in an increase in globally averaged surface temperature of 1.4 to 5.8°C over the period 1990 to 2100. This is about two to ten times larger than the central value of observed warming over the 20th century and the projected rate of warming is very likely to be without precedent during at least the last 10,000 years, based on paleoclimate data.

In the four years since the 2001 IPCC Report, the scientific consensus on global warming has only grown stronger (ACIA 2004a), and the warnings from climate scientists more urgent (e.g., Stott 2004; Stainford 2005;). While there is continuing scientific debate on specifics such as the rate or likely regional consequences of global warming, and while there are policy debates on what can and should be done to address global warming, the "best available science" clearly and unequivocally demonstrates that global warming is upon us and will bring profound changes to the world's climate over the course of this century and beyond.



Global Warming's Impact on the Arctic

Global warming is already having pronounced impacts on the Arctic. In November 2004 the Arctic Climate Impact Assessment's ("ACIA's") report on *Impacts of a Warming Arctic* (ACIA 2004a) was released. The ACIA is "a comprehensively researched, fully referenced, and independently reviewed evaluation of arctic climate change and its impacts for the region and for the world. It has involved an international effort by hundreds of scientists over four years, and also includes the special knowledge of indigenous people" (ACIA 2004a:v). The ACIA report concludes that greenhouse gas driven climate changes "are being experienced particularly intensely in the Arctic. Arctic average temperature has risen at almost twice the rate as the rest of the world in the past few decades. Widespread melting of glaciers and sea ice and rising permafrost temperatures present additional evidence of strong arctic warming" (ACIA 2004a:8). Significantly, "acceleration of these climatic trends is projected to occur during this century, due to ongoing increases in concentrations of greenhouse gases in the earth's atmosphere" (ACIA 2004a:8).

The ACIA's analysis and conclusions regarding Arctic temperature increases are dramatic. For example:

In Alaska and western Canada, winter temperatures have increased by as much as 3-4° C (5-7°F) in the past 50 years. Over the next 100 years, under a moderate emissions scenario, annual average temperatures are projected to rise 3-5°C (5-9°F) over land and up to 7° C (13°F) over the oceans. Winter temperatures are projected to rise by 4-7°C (5-9°F) over land and 7-10°C (13-18°) over the oceans. (ACIA 2004b:2).

This ongoing and projected warming has already and will continue to severely reduce the extent of sea-ice coverage:

Over the past 30 years, the annual average sea-ice extent has decreased by about 8%, or nearly one million square kilometers (386,100 square miles), an area larger than all of Norway, Sweden, and Denmark (or Texas and Arizona) combined, and the melting trend is accelerating. Sea-ice extent in summer has declined more dramatically than the annual average, with a loss of 15-20% of the late-summer ice coverage. Additional declines of 10-50% in annual average sea-ice extent are projected by 2100. Loss of sea-ice during summer is projected to be considerably greater, with a 5-model average projecting more than a 50% decline by late this century, and some models showing near-complete disappearance of summer sea ice. (ACIA 2004b:3).

In sum, the impacts of global warming on the Arctic are already being felt with a rise in temperature and a consequent decline in sea ice. Under relatively optimistic future emissions scenarios, summer sea ice will likely decline 50-100% by the end of the century. Under any scenario, the future of ice-dependent species such as the polar bear is grim.

The Future of Polar Bears in a Warming Arctic

Polar bears are completely dependent upon Arctic sea-ice habitat for survival. Polar bears need sea ice as a platform from which to hunt their primary prey (ringed seals, *Phoca hispida*), to make seasonal migrations between the sea ice and their terrestrial denning areas, and for other essential behaviors such as mating. Unfortunately, the polar bear's sea-ice habitat is quite literally melting away.



Canada's Western Hudson Bay population, at the southern edge of the species' range, is already showing the impacts of global warming. Break-up of the annual ice in Western Hudson Bay is now occurring on average 2.5 weeks earlier than it did 30 years ago. Earlier ice break-up is resulting in polar bears having less time on the ice to hunt seals. Polar bears must maximize the time they spend on the ice feeding before they come ashore, as they must live off built-up fat reserves for up to 8 months before ice conditions allow a return to hunting on the ice. The reduced hunting season has translated into thinner bears, lower female reproductive rates, and lower juvenile survival. While population declines are not yet evident in Hudson Bay, polar bear scientists calculate that if sea-ice trends continue, most female polar bears in the Western Hudson Bay population will be unable to reproduce by the end of the century, and possibly as early as 2012 (Derocher et al. 2004). Without reproduction, this population is doomed to extinction.

While Western Hudson Bay is the only population in which scientists have already observed negative impacts from climate change and published their results in peer-reviewed journals, impacts that have not yet been documented may be occurring in other less well-studied populations as well. Regardless, the consequences of future sea-ice reductions for polar bears globally will be severe. According to the ACIA, "the reduction in sea ice is very likely to have devastating consequences for polar bears, ice-dependent seals, and local people for whom these animals are a primary food source." (ACIA 2004b:1). The ACIA concludes that "polar bears are unlikely to survive as a species if there is an almost complete loss of summer sea-ice cover, which is projected to occur before the end of this century by some climate models....The loss of polar bears is likely to have significant and rapid consequences for the ecosystems that they currently occupy." (ACIA 2004a:58) (emphasis added).

A 2004 peer-reviewed analysis looking at all aspects of global warming's impacts on the polar bear by three of the world's foremost experts on the species, *Polar bears in a warming climate* (Derocher et al. 2004:163), came to a similar conclusion as the ACIA, stating that "it is unlikely that polar bears will survive as a species if the sea ice disappears completely as has been predicted by some."

Even short of complete disappearance of sea ice, projected impacts to polar bears from global warming will affect virtually every aspect of the species' existence, in most cases leading to reduced body condition and consequently reduced reproduction or survival:

- The timing of ice formation and break-up will determine how long and how efficiently polar bears can hunt seals. A reduction in the hunting season caused by delayed ice formation and earlier break-up will mean reduced fat stores, reduced body condition, and therefore reduced survival and reproduction.
- Reductions in sea ice will in some areas result in increased distances between the ice edge and land. This will make it more difficult for female bears that den on land to reach their preferred denning areas. Bears will face the energetic trade-off of either leaving the sea ice earlier when it is closer to land or traveling further to reach denning areas. In either case, the result is reduced fat stores and likely reduced survival and reproduction.
- Reductions in sea-ice thickness and concentration will likely increase the energetic costs of traveling as moving through fragmented sea ice and open water is more energy intensive than walking across consolidated sea ice.



- Reduced sea-ice extent will likely result in reductions in the availability of ice-dependent prey such as ringed seals, as prey numbers decrease or are concentrated on ice too far from land for polar bears to reach.
- Global warming will likely increase the rates of human/bear interactions, as greater portions of the Arctic become more accessible to people and as polar bears are forced to spend more time on land waiting for ice formation. Increased human/bear interactions will almost certainly lead to increased polar bear mortality.
- The combined effects of these impacts of global warming on individual bears' reproduction and survival are likely to ultimately translate into impacts on polar bear populations. Impacts will be most severe on female reproductive rates and juvenile survival. In time, reduction in these key demographic factors will translate into population declines and extirpations.

In sum, changes in sea-ice extent, thickness, movement, fragmentation, location, duration, and timing will have significant and often adverse impacts on polar bear feeding, breeding, and movement. Such impacts will likely result in reduced reproductive success and higher juvenile mortality, and in some cases increased adult mortality. By century's end the combined effects of these demographic changes will likely result in population declines and extirpations, and possible global extinction of the species.

Summarizing the various likely impacts of global warming on the polar bear, Derocher et al. (2004:172) come to the following sobering conclusion:

In contrast to many terrestrial and most marine species that may be able to shift northward as the climate warms, polar bears are constrained in that the very existence of their habitat is changing and there is limited scope for a northward shift in distribution. Due to the long generation time of polar bears and the current pace of climate warming, we believe it unlikely that polar bears will be able to respond in an evolutionary sense. Given the complexity of ecosystem dynamics, predictions are uncertain but we conclude that the future persistence of polar bears is tenuous. (emphasis added).

In addition to the suite of impacts from global warming, polar bears also face additional threats such as increasing oil exploration and development and risk of oil spills throughout the Arctic, serious impacts to the immune system and reproductive system from exceptionally high levels of contaminants such as PCBs, unsustainable hunting and illegal poaching in some areas, and increased human activity in the Arctic. Global warming will likely interact with several of these additional threats in a synergistic and cumulative fashion, further increasing the polar bear's peril.

Existing Legal Mechanisms are Inadequate to Address Global Warming and Prevent the Likely Extinction of the Polar Bear

Global warming due to anthropogenic greenhouse gas emissions is the primary threat to polar bears, and also one of the most difficult threats to regulate. Despite the scientific consensus that global warming is in fact occurring, and will have dramatic effects across the world, greenhouse gas emissions continue to increase both globally and domestically. Existing regulatory mechanisms such as the United Nations Framework Convention on Climate Change and the Kyoto Protocol have to date been



completely ineffective at actually reducing greenhouse gas emissions. At best, they have slowed the rate of increase. However, even if fully implemented, (an unlikely scenario given the United States, the world's largest emitter of greenhouse gases, has officially renounced the Kyoto Protocol) these mechanisms will not reduce greenhouse gas emissions sufficiently to avoid the warming of the Arctic and consequent adverse impacts to polar bears that are already occurring or will occur by the end of the century. As such, it is clear that existing regulatory mechanisms are inadequate to prevent the polar bear from becoming an endangered species in the foreseeable future.

The United Nations Framework Convention on Climate Change ("UNFCCC") was adopted in May 1992 at the first Earth Summit held in Rio de Janeiro, Brazil, and entered into force in March 1994 (Energy Information Administration ("EIA") 2004). The stated objective of the UNFCCC is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (EIA 2004). Due to the complexity of climate issues and the widely divergent political positions of the world's nation states, the UNFCCC itself was unable to set emissions targets or limitations, but instead created a framework that sets the stage for a range of subsequent actions (UNFCCC 2004). In other words, the UNFCCC is a mechanism for future agreements that might result in actual greenhouse gas emission reductions; it does not require any actual reductions in such emissions. As such, in and of itself, it is wholly inadequate to prevent further greenhouse gas emissions and consequent global warming.

In 1997 the Kyoto Protocol became the first additional agreement added to the UNFCCC to set emissions targets. The Kyoto Protocol set goals for developed countries only to reduce their emissions to at least 5% below their 1990 levels (UNFCCC 2004). Over seven years passed before the Kyoto Protocol entered into force on February 16, 2005 (UNFCCC 2005). While the entry into force of the Kyoto Protocol is an important symbolic first step in the necessary global response to climate change, it is inadequate to prevent sufficient build up of greenhouse gases to avoid significant warming of the Arctic and the consequent likely extinction of the polar bear. First, the Protocol's overall emissions targets are highly unlikely to be met, due in large part to the refusal of the United States to ratify the agreement. The United States accounts for approximately 24% of worldwide carbon dioxide emissions (EIA 2004). The Kyoto target for the United States was a 7% reduction in greenhouse gas emission levels from 1990 levels by 2012 (EIA 2004). According to the U.S. Government Accounting Office ("GAO"), between 1990 and 2001, United States emissions have in fact increased by 13%. Total United States emissions are projected to grow a staggering additional 43.5% through the period 2025 (GAO 2003a). The United States simply will not meet Kyoto targets by the Protocol's 2012 deadline. Without United States compliance, global Kyoto targets are unlikely to be met. Overall, the EIA estimates that worldwide carbon emissions in 2025 will exceed 1990 levels by 72% (EIA 2004).

Moreover, even in the unlikely event that overall Kyoto targets were fully met by the year 2012, the reductions are far too small to substantially reduce Arctic warming and consequent sea-ice reduction sufficiently to protect the polar bear. Implementation of the Kyoto Protocol would only slightly reduce the rate of growth of emissions – it would not stabilize them (Williams 2002). Carbon dioxide levels had risen to 379 ppm by March 2004, from pre-industrial levels of 280 ppm (International Climate Change Taskforce 2005). Stabilizing carbon dioxide concentrations at 440 ppm (23% above current levels) would require global emissions to drop below 1990 levels within a few decades, with emissions eventually declining to a very small fraction of current levels, despite growing human populations and an expanding world economy. These cuts will not be achieved simply by compliance with Kyoto (Williams 2002).



Most significantly, the ACIA projections of likely polar bear extinctions are based upon climate models that already assume future reductions in greenhouse gas emissions. Predictions of 50-100% loss of summer sea ice come from models using projected emissions levels that fall slightly below the average of possible scenarios. Actual impacts will likely be much greater. Only by implementing major cuts in greenhouse gas emissions in the very near future will a scenario be possible in which sufficient sea ice remains that the polar bear can persist as a species.

Conclusion

The future of the polar bear is indeed grim. While most populations are currently reasonably healthy and the global population is not presently endangered, the species as a whole faces the likelihood of severe endangerment and possible extinction by the end of the century. As such, it will be endangered in the foreseeable future and therefore meets the criteria for listing now as Threatened under the ESA. While the polar bear will likely not disappear for several decades, decisions made and actions taken over the next decade will likely dictate whether the species can survive. Only with prompt action to drastically reduce greenhouse gas emissions can the future of the polar bear be assured. The United States must play a leading role in this global effort. Listing the species under the ESA is a small but significant step in that direction.



Notice of Petition

Pursuant to Section 4(b) of the Endangered Species Act (“ESA”), 16 U.S.C. §1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. §424.14(a), Petitioner Center for Biological Diversity hereby petitions the Secretary of the Interior, through the United States Fish and Wildlife Service (“FWS”), to list the polar bear (*Ursus maritimus*) as a threatened or endangered species and designate critical habitat to ensure its recovery.

The FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on FWS. Specifically, FWS must issue an initial finding as to whether the petition “presents substantial scientific or commercial information indicating that the petitioned action may be warranted.” 16 U.S.C. §1533(b)(3)(A). FWS must make this initial finding “[t]o the maximum extent practicable, within 90 days after receiving the petition.” *Id.* Petitioners need not demonstrate that listing *is* warranted, rather, Petitioners must only present information demonstrating that such listing *may* be warranted. While Petitioners believe that the best available science demonstrates that listing the polar bear as threatened *is* in fact warranted, there can be no reasonable dispute that the available information indicates that listing the species *may* be warranted. As such, FWS must promptly make a positive initial finding on the petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

The term “species” is defined broadly under the ESA to include “any subspecies of fish or wildlife or plants and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” 16 U.S.C. § 1532 (16). A Distinct Population Segment (“DPS”) of a vertebrate species can be protected as a “species” under the ESA even though it has not formally been described as a separate “species” in the scientific literature. A species may be composed of several DPSs, some or all of which warrant listing under the ESA. As described in this petition, the polar bear is currently recognized as a single species, *Ursus maritimus*. However, scientists also recognize twenty polar bear populations, each of which meets the criteria for designation as a distinct population segment under the ESA and FWS’s “Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act.” 61 Fed. Reg. 4721. Additionally and alternatively, four polar bear population “clusters” have been described based on genetic analyses, and each of these four populations also qualifies as a distinct population segment. As such, each of the 20 separate polar bear populations and, alternatively, each population cluster constitutes a “species” under the ESA.

Therefore, Petitioners request that FWS evaluate whether the full polar bear species qualifies for listing as threatened or endangered. In the event that the FWS finds that this petition does not present substantial information indicating that listing of the full polar bear species may be warranted, Petitioners request that the FWS evaluate whether each of the 20 polar bear populations qualifies as a distinct population segment, and if so, if each qualifies for listing as threatened or endangered. Additionally, Petitioners request that the FWS evaluate whether each of the four polar bear population “clusters” described in the Petition qualifies as a distinct population segment, and if so, if each qualifies for listing as threatened or endangered. The scientific basis for the requested listing is set forth fully in the Petition.

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Respectfully submitted this 16th day of February, 2005

Kassie R. Siegel

Kassie R. Siegel, Staff Attorney
Center for Biological Diversity
P.O. Box 493
Idyllwild, CA 92549
Tel: (951) 659-6053
Fax: (951) 659-2484
Email: ksiegel@biologicaldiversity.org

The Center for Biological Diversity ("Center") is a non-profit, public interest conservation organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 11,000 members throughout the United States and internationally. The Center and its members are concerned with the conservation of endangered species, including polar bears, and the effective implementation of the Endangered Species Act.

